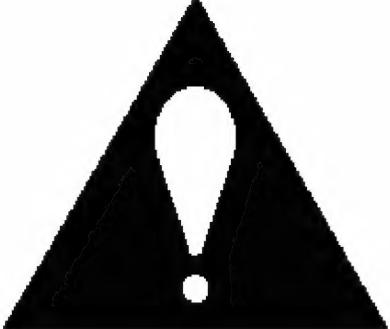


2006 STEERING**Variable Effort Steering - Lucerne****SCHEMATIC AND ROUTING DIAGRAMS****STEERING ASSIST SCHEMATIC ICONS****Steering Assist Schematic Icons**

Icon	Icon Definition
	<p>IMPORTANT:</p> <p>Twisted-pair wires provide an effective shield that helps protect sensitive electronic components from electrical interference. If the wires were covered with shielding, install new shielding.</p> <p>In order to prevent electrical interference from degrading the performance of the connected components, you must maintain the proper specification when making any repairs to the twisted-pair wires shown :</p> <ul style="list-style-type: none">● The wires must be twisted a minimum of 9 turns per 31 cm (12 in) as measured anywhere along the length of the wires● The outside diameter of the twisted wires must not exceed 6.0 mm (0.25 in).

STEERING ASSIST SCHEMATICS

2006 Buick Lucerne CXS

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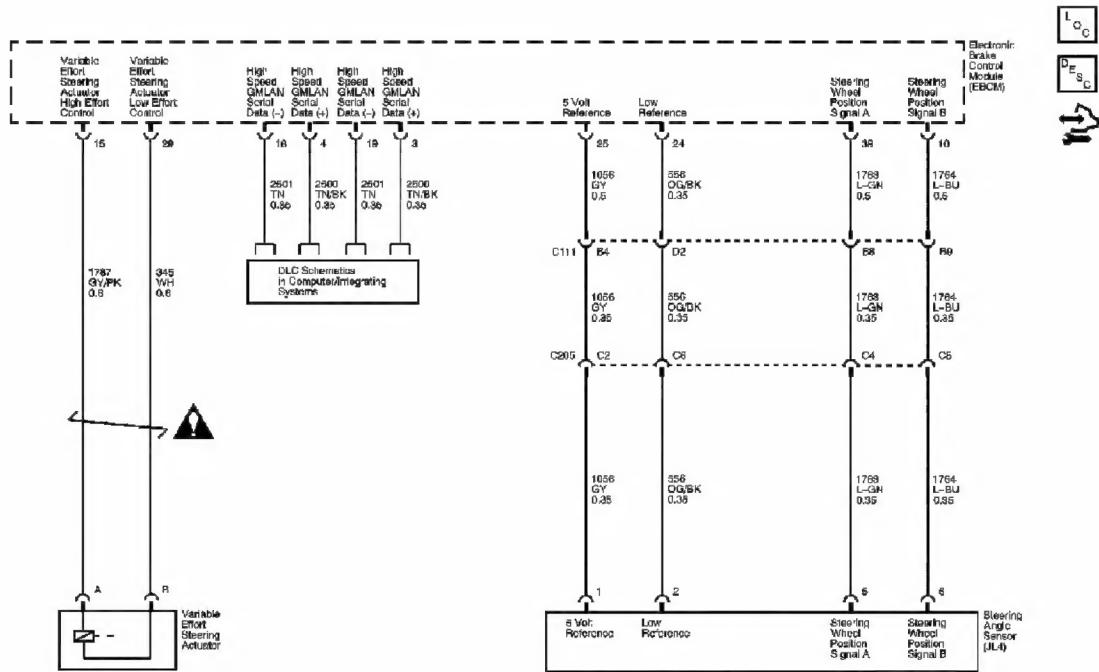


Fig. 1: Variable Effort Steering Schematic
Courtesy of GENERAL MOTORS CORP.

COMPONENT LOCATOR

STEERING ASSIST COMPONENT VIEWS

2006 Buick Lucerne CXS

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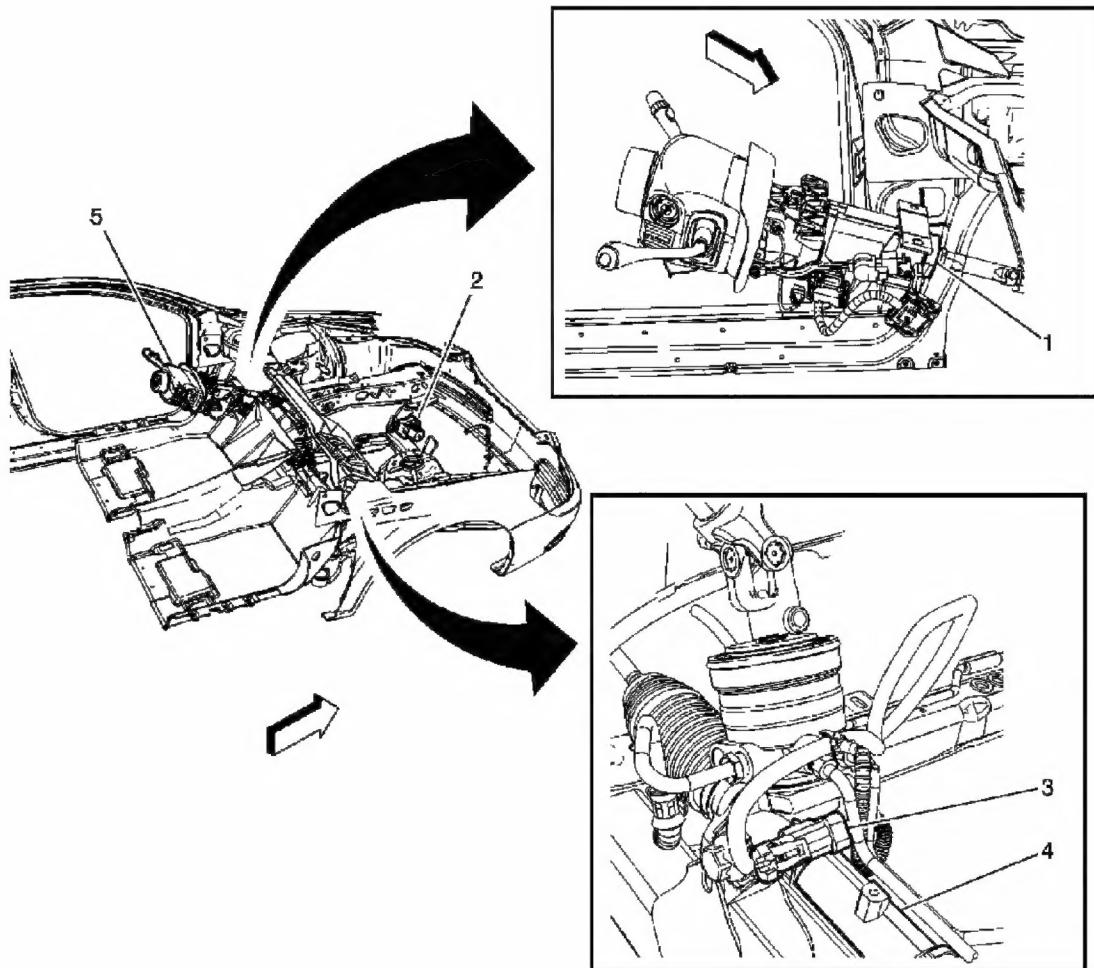


Fig. 2: Identifying Power Steering Components

Courtesy of GENERAL MOTORS CORP.

Callouts For Fig. 2

Callout	Component Name
1	Steering Angle Sensor (JL4)
2	Electronic Brake Control Module (EBCM)
3	Variable Effort Steering Actuator
4	Power Steering Rack
5	Steering Column Assembly

STEERING ASSIST CONNECTOR END VIEWS

Steering Angle Sensor (JL4)

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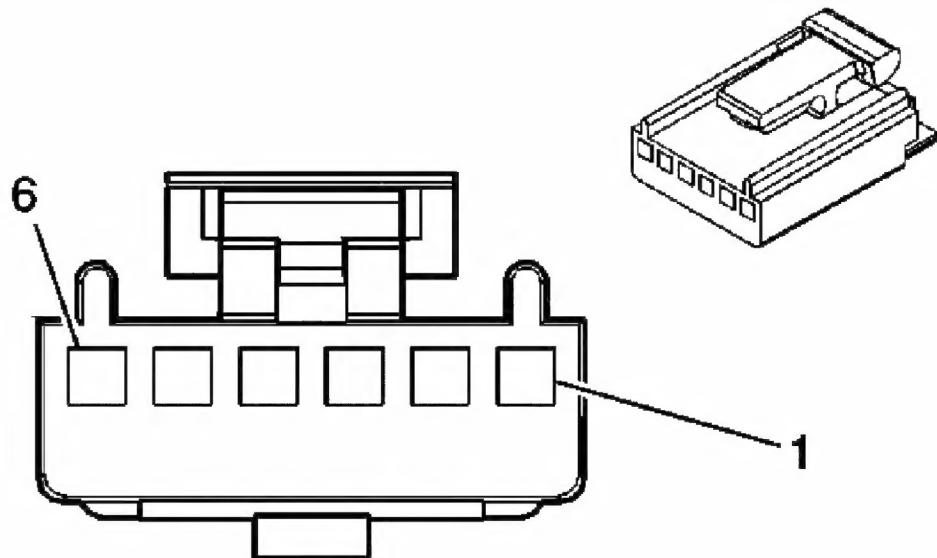


Fig. 3: Steering Angle Sensor (JL4) Connector End View
Courtesy of GENERAL MOTORS CORP.

Steering Assist Connector End Views

Connector Part Information

- OEM: 12064978
- Service: See Catalog
- Description: 6-Way F Micro-Pack 100 Series (GY)

Terminal Part Information

- Pins: 1, 2, 5, 6
- Terminal/Tray: See Terminal Repair Kit
- Core/Insulation Crimp: See Terminal Repair Kit
- Release Tool/Test Probe: See Terminal Repair Kit

Steering Angle Sensor (JL4)

Pin	Wire Color	Circuit No.	Function
1	GY	1056	5-Volt Reference
2	OG/BK	556	Low Reference

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Pin	Wire Color	Circuit No.	Not Used	Function
5	L-GN	17636	Steering Reference Position Signal A	
6	DB-BK	17636	Steering Wheel Position Signal B	

Variable Effort Steering Actuator (JL4)

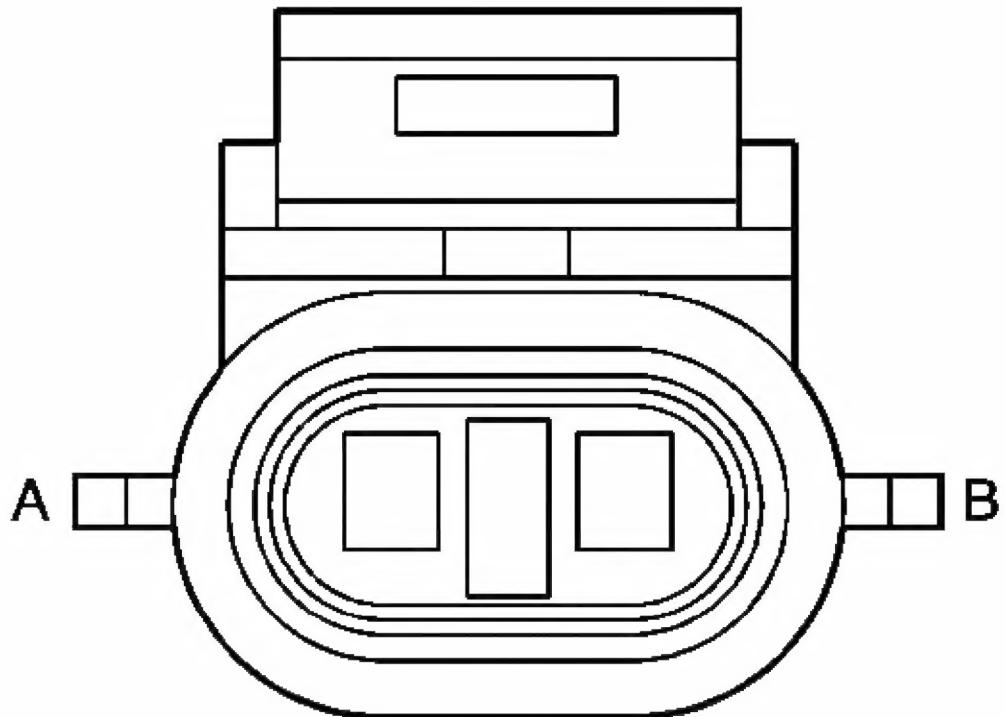


Fig. 4: Variable Effort Steering Actuator (JL4) Connector End View
Courtesy of GENERAL MOTORS CORP.

Steering Assist Connector End Views

Connector Part Information

- OEM: 12186685
- Service: 12102747
- Description: 2-Way F Metri-Pack 150 Series Sealed (BK)

Terminal Part Information

- Terminal/Tray: 12048074/2

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- ~~Connection Part Information~~
- ~~Relation~~ Tool/Test Probe: 12094429/J-35616-2A (GY)

Variable Effort Steering Actuator (JL4)

Pin	Wire Color	Circuit No.	Function
A	GY/PK	1787	Variable Effort Steering Actuator High Effort Control
B	WH	345	Variable Effort Steering Actuator Low Effort Control

DIAGNOSTIC INFORMATION AND PROCEDURES

DIAGNOSTIC STARTING POINT - VARIABLE EFFORT STEERING

Begin the system diagnosis with the **Diagnostic System Check - Vehicle**. The Diagnostic System Check will provide the following information:

- The identification of the control modules which command the system
- The ability of the control modules to communicate through the serial data circuit
- The identification of any stored DTCs and their status

The use of the Diagnostic System Check will identify the correct procedure for diagnosing the system and where the procedure is located.

SCAN TOOL OUTPUT CONTROLS

Scan Tool Output Controls

Scan Tool Output Control	Additional Menu Selections	Description
VES actuator	VES test	The Electronic Brake Control Module (EBCM) can be commanded using the scan tool to perform a self-test varying steering effort from more firm, to less firm, to more firm, then back to normal.

SCAN TOOL DATA LIST

Scan Tool Data List

Scan Tool Parameter	Data List	Units Displayed	Typical Data Value
Ignition ON/engine ON/no vehicle speed present			
ABS Reference Speed	VES Data	mph	0

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Scan Tool Parameter	VES Data	Units Displayed	Typical Value
LF Wheel Speed	VES Data	mph	
LR Wheel Speed	VES Data	mph	0
RF Wheel Speed	Ignition ON/engine ON Data	Vehicle speed present	0
RR Wheel Speed	VES Data	mph	0 0
Ignition Voltage	VES Data	Volts	13.25
Switched System Battery Voltage	VES Data	Volts	13.25
VES Failed	VES Data	Yes/No	No
VES Indicator Message	VES Data	On/Off	Off
VES Commanded Current	VES Data	amps	1.00
VES Feedback Current	VES Data	amps	1.00

SCAN TOOL DATA DEFINITIONS

ABS Reference Speed

The scan tool displays 0-255 km/h (0-159 mph). The average speed of all four wheel speed sensors.

Ignition Voltage

The scan tool displays 0-17 volts. The amount of ignition voltage available at the Electronic Brake Control Module (EBCM).

LF Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left front wheel.

LR Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the left rear wheel.

RF Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right front wheel.

RR Wheel Speed

The scan tool displays 0-255 km/h (0-159 mph). The actual speed of the right rear wheel.

Switched System Battery Voltage

The scan tool displays 0-17 volts. The amount of voltage available to the VES actuator

when the ABS relay is activated.

VES Commanded Current

The scan tool displays 0-1 amp. The amount of current the EBCM is commanding to the VES actuator.

VES Failed

The scan tool displays Yes or No. Yes indicates a malfunction has been detected within the VES system. No indicates the VES system is operating to specification.

VES Feedback Current

The scan tool displays 0-1 amp. The amount of current returning to the EBCM from the VES actuator.

VES Indicator/Message

The scan tool displays On or Off. Indicates the status of the VES system DIC warning message.

DTC C0450

Diagnostic Instructions

- Perform the **Diagnostic System Check - Vehicle** prior to using this diagnostic procedure.
- Review **Strategy Based Diagnosis** for an overview of the diagnostic approach.
- **Diagnostic Procedure Instructions** provides an overview of each diagnostic category.

DTC Descriptors

DTC C0450 0B

Steering Assist Control Actuator Circuit Current Above Threshold

DTC C0450 11

Steering Assist Control Actuator Circuit Above Maximum Threshold

DTC C0450 17

Steering Assist Control Actuator Circuit Signal Waveform Failure

Circuit/System Description

The electronic brake control module (EBCM) commands current from 0-3 amps to the variable effort steering (VES) actuator, depending on vehicle speed. At low speeds, 0 amps of current is commanded to the actuator and the steering gear receives full flow of power steering fluid causing less effort to steer vehicle. As vehicle speed increases, the amount of amps increases to the actuator causing fluid to bypass steering gear. This limits hydraulic assist to steering gear causing firm steering. The EBCM monitors and compares the VES Commanded Current and VES Feedback Current parameters to detect malfunctions in the VES System.

Conditions for Running the DTC

- The ignition is ON.
- Ignition voltage is greater than 8 volts.

Conditions for Setting the DTC**C0450 0B**

The actuator current exceeds 4.5 amps.

C0450 11

The actuator current is detected as greater than 50 percent of its expected current while the actuator is commanded OFF.

C0450 17

The current through the actuator is not within 0.5 amp of its commanded value.

Action Taken When the DTC Sets

- The driver information center (DIC) will display SERVICE POWER STEERING message.
- Vehicle speed will be limited to 80 mph.

Conditions for Clearing the DTC

- The condition for setting the DTC is no longer present and the DTC is cleared with a scan tool.
- The EBCM automatically clears the history DTC when a current DTC is not detected in 100 consecutive drive cycles.

Reference Information**Schematic Reference**

Steering Assist Schematics

Connector End View Reference

Steering Assist Connector End Views

Electrical Information Reference

- **Circuit Testing**
- **Connector Repairs**
- **Testing for Intermittent Conditions and Poor Connections**
- **Wiring Repairs**

Scan Tool Reference

Scan Tool Data List

Circuit/System Verification

With the engine ON, while turning the steering wheel, use a scan tool to command VES actuator ON. The steering wheel should take more effort to turn. Command the VES actuator OFF. The steering wheel should take less effort to turn.

Circuit/System Testing

1. Ignition OFF, disconnect the VES actuator harness connector.
2. Measure for 0 volts between the variable effort steering actuator supply voltage circuit and ground.
 - If over 0 volts, test the variable effort steering actuator supply voltage circuit for short to voltage. If the circuit tests normal, replace the EBCM.
3. Ignition ON, measure for 12 volts between the variable effort steering actuator supply voltage circuit and ground.
 - If under 12 volts, test the variable effort steering actuator supply voltage circuit for short to ground or open/high resistance. If the circuit tests normal, replace the EBCM.
4. Connect a test lamp between the variable effort steering actuator supply voltage circuit and the variable effort steering actuator control circuit at the VES actuator harness connector.
5. Using a scan tool, command the VES actuator ON. Verify the test lamp illuminates.
 - If the test lamp does not illuminate, test the variable effort steering actuator control circuit for open/high resistance. If the circuit tests normal, replace the EBCM.
6. If all circuits test normal, test or replace the VES actuator.

Component Testing

1. Ignition OFF, disconnect the VES actuator harness connector.
2. Measure for 5-10 ohms of resistance between the VES actuator terminals.
 - If not 5-10 ohms of resistance, replace the VES actuator.
3. Measure for infinite ohms of resistance between each VES actuator terminal and the VES actuator housing.
 - If less than infinite ohms of resistance, replace the VES actuator.

Repair Procedures

Perform the **Diagnostic Repair Verification** after completing the diagnostic procedure.

- **Steering Gear Replacement**
- **Control Module References** for EBCM replacement, setup and programming

DESCRIPTION AND OPERATION**VARIABLE EFFORT STEERING SYSTEM DESCRIPTION AND OPERATION**

The Variable Effort Steering (VES) System varies the amount of effort to steer the vehicle as wheel speed changes or lateral acceleration occurs. The electronic brake control module (EBCM) controls an actuator located in the steering rack and pinion. The actuator consists of an electromagnetic coil and a pintle valve which moves in and out of the rack and pinion's input fluid orifice, regulating power steering fluid flow. The EBCM commands current from 0-3 amps to the VES actuator which varies the amount of effort to steer the vehicle. At low speeds, 0 amps of current is commanded to the VES solenoid and the steering gear receives maximum fluid flow and maximum steering assist for easy turning and parking maneuvers. As speed increases, the amount of current increases to the VES actuator. The VES actuator decreases fluid flow which provides firmer steering, increased road feel and directional stability. The VES system uses the steering wheel position sensor input to calculate lateral acceleration during abrupt driving maneuvers. The system also uses the Antilock Brake System (ABS) wheel speed sensor inputs to determine vehicle speed. The EBCM is constantly monitoring these inputs to achieve the desired current to the VES actuator. The EBCM has the ability to detect malfunctions in the VES actuator or the circuits to the actuator. Any malfunctions detected will cause the VES outputs to be disabled and the EBCM will command the driver information center (DIC) to display the SERVICE STEERING SYSTEM warning message via a class 2 serial data circuit.

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